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Assessment of Hyperfibrinolysis in Liver Transplantation Surgery as Measured by Rotational Thromboelastometry

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Incidence of Fibrinolysis in Modern Liver Transplantation

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Introduction to Liver transplantation fibrinolysis

- Fibrinolysis is a recognized problem during liver transplant surgeries, especially during the reperfusion phase[1]
- Modern liver transplantations use significantly less amounts of blood products compared to historical liver transplantations [2]
- The rate of fibrinolysis may have changed alongside improving surgical techniques, thus patients may be receiving unnecessary blood products
- Liver transplant surgical techniques may become more efficient, safer, and less costly if fibrinolysis is not happening as frequently as what is currently believed

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Research Question

Research question: Using a Rotational thromboelastometry (ROTEM) machine to measure clotting, is the rate of fibrinolysis during modern liver transplant surgery as high as what is currently believed (~15%)?

Image source: World Federation of Societies of Anesthesiologists

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Hypothesis: The patients who underwent liver transplantation surgeries at Jefferson from 2013-2019 have a significantly lower (<5%) rate of hyperfibrinolysis, as measured by ROTEM clotting parameters, compared to what has been described in previous literature (~15%).

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Methods

- Retrospective chart review using ROTEM data from 312 liver transplant surgeries that took place at Jefferson from 2013-2019
  - ROTEM (Rotational thrombelastography): a machine capable of intraoperatively assessing several qualities of a clot from a whole blood assay
    - Rate of fibrinolysis, clot formation time, clot strength etc.
- Data collection: The data was taken from the ROTEM machines and has been matched with patient information from EPIC
- Analysis: Blood was collected at several distinct time points during the surgery and the clotting profile was assessed
- Outcome of interest: Is hyperfibrinolysis* present at any point during the surgery?

*Hyperfibrinolysis is defined a Maximum Lysis Value greater than 15% on NATEM
And a correction of hyperfibrinolysis on APTEM

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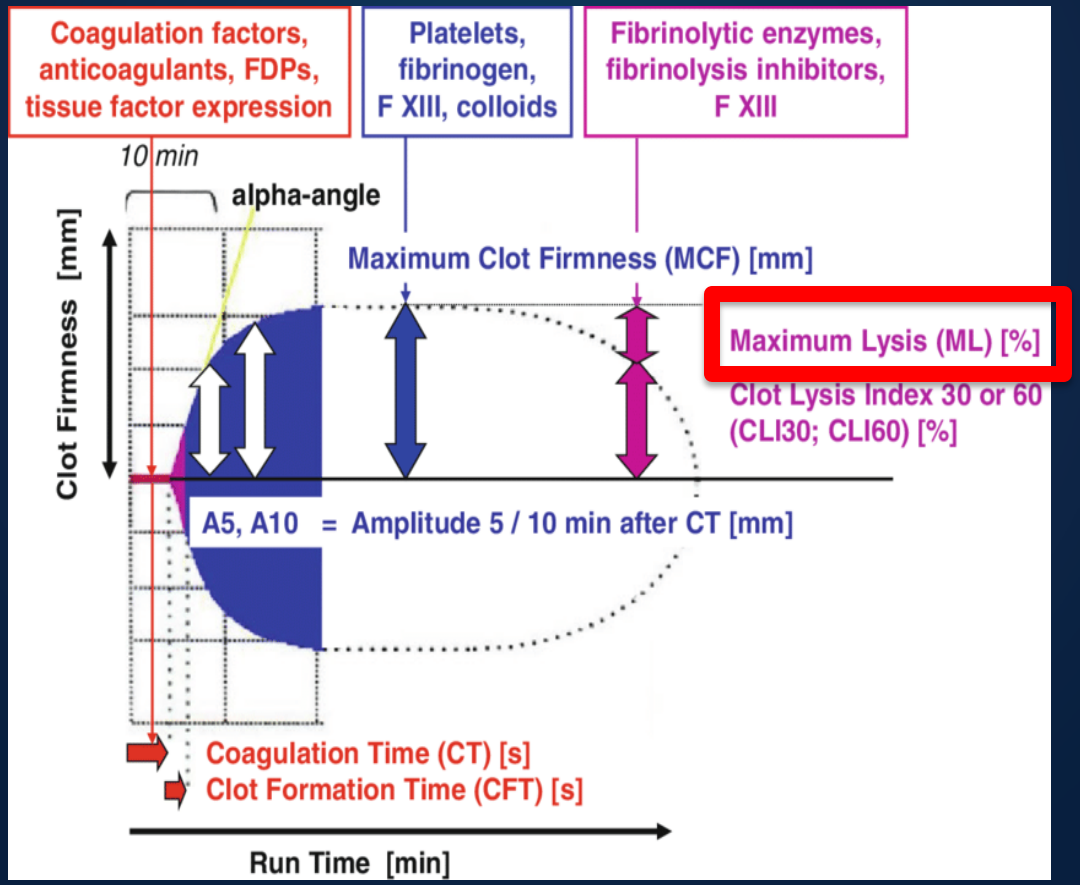
Methods continued

- An example of the type of data that ROTEM provides [3]
- Note, this information is available during surgery



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Results

- Population:
  - Average age at transplantation was 58±11.2 years
  - About 67% of the recipients were men
  - Alcohol (24%), Hepatitis C (22%), and HCC (21%) were the most common reasons for transplantation
- Hyperfibrinolysis:
  - There were 20 patients out of 321 (6.1%) who had hyperfibrinolysis
  - Factors not found to be related to hyperfibrinolysis
    - MELD score
    - INR
    - Intraoperative clot strength
  - Factors found to be related to hyperfibrinolysis
    - Non-alcohol reason for transplantation
    - Multiple causative factors of liver injury
    - Age
    - Third stage of surgery

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Conclusions

- Overall, the study appears to show that hyperfibrinolysis occurs less often than what is currently believed
- Potential predicative factors such as age, and reason for transplantation have been identified
- Hyperfibrinolysis remains a serious concern during liver transplantation surgeries and still needs to be rigorously monitored

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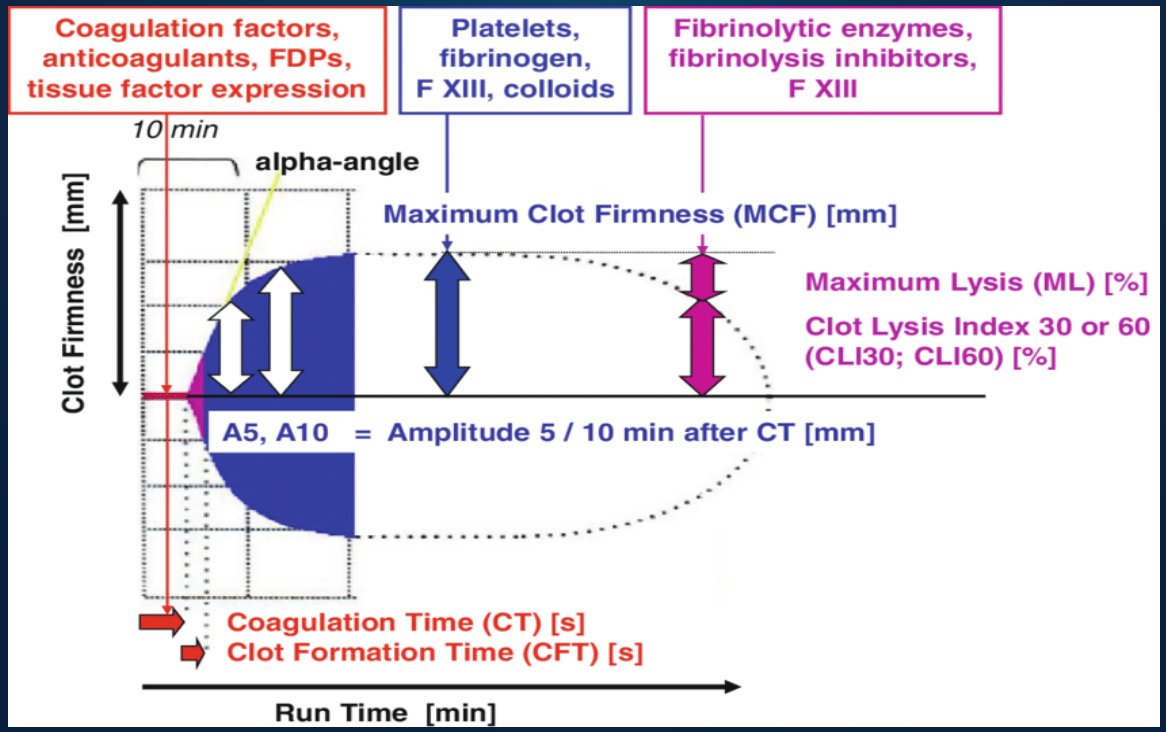
Future Directions

- Search the data base for additional clotting parameters that can be used to predict coagulopathies
- Gather additional demographic and anesthesia information from the surgeries



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